of 1 or more agrochemical active ingredients and an inert fine powder whereby the oil-nonabsorbing granular carrier is coated with the agrochemical active ingredients or with the mixture of agrochemical active ingredients and an inert fine powder.

[Detailed Description of the Invention]

[0001]

[Fields in Industry]

The present invention relates to novel coating type granules for agriculture and horticulture which can be safely used as well as a process for producing said granules.

[0002]

[Prior Art]

In recent years, granules are used preferably for labor saving and safety at the time of spraying in the operation of weeding and controlling insects causing damage to crops, and the granules are utilized in the fields of insecticide, bactericide and herbicide. Granules for agriculture and horticulture are generally classified into 3 types of granules, that is, extrusion type granules, adsorption type granules and coating type granules, and the optimum form is selected depending on the physicochemical properties and application field of agrochemical active ingredients.

[0003]

The extrusion type granules are produced generally by previously mixing agrochemical active ingredients well with

mineral fine powder etc., grinding the mixture if necessary, adding water usually for kneading thereof, extrusion-granulation thereof through a screen having a predetermined mesh size, and drying thereof. The adsorption type granules are produced generally by dissolving agrochemical active ingredients in the form of liquid, solid or semi-solid in a solvent and then allowing its solution to be mixed with, and absorbed into, a preliminarily selected oil-absorbing granular carrier having a predetermined distribution of particle size.

[0004]

The coating type granules are produced generally by allowing an adhesive and agrochemical active ingredients, and if necessary mineral fine powder etc., to be mixed with, and absorbed into, a preliminarily selected oil-nonabsorbing granular carrier having a predetermined distribution of particle size. If water is used as the adhesive, the granules after mixed and coated are dried in many cases.

[0005]

The extrusion type granules are produced generally through the steps of mixing, kneading, granulating, drying, sizing and screening. On the other hand, the adsorption type granules and coating type granules can be produced through only the steps of mixing and screening (for the coating type granules, the drying step may be necessary after the mixing step), so

these types of granules are more advantageous than the extrusion type granules in respect of costs for facilities, costs for the operation, management of the steps and production efficiency.

[0006]

Further, the adsorption type granules usually make use of a granular, oil-absorbing mineral material as the absorbing carrier, so the content of agrochemical ingredients to be absorbed into the granules will be limited depending on the ability of the granular mineral material to absorb oil. Further, the ability of the granular mineral material to absorb oil may vary depending on the place of production thereof, and therefore there is a problem with varying qualities of the granular material. In the coating type granules, there is none of such problem. The coating type granules are granules which are superior in the above-described features to the extrusion type granules and adsorption type granules.

[0007]

[Problem to be solved by the Invention]

In the conventional coating type granules, however, an agrochemical active ingredient is distributed at high density on the surface of the oil-nonabsorbing granular carrier, and thus the agrochemical active ingredient is readily removed from the granular carrier when the granules are rubbed against one another at the time of transportation and spraying, so the

granules has a problem with safety in that for example, the agrochemical active ingredient removed from the granular carrier, when used by spraying, is inhaled by the worker or scattered in the environment.

[0008]

To solve the problems described above, there is proposed a method in which a vinyl acetate polymer or copolymer dissolved as an adhesive in an organic solvent is used to spread an agrochemical active ingredient on the oil nonabsorbing granular carrier (JP-B 55-39521). In this prior art method, however, use of the organic solvent brings about the problem of flammability at the time of production and transportation as well as the problem of the stimulation and toxicity of the evaporated organic solvent toward the worker at the time of production and transportation.

[0009]

Further, the respective components are stirred and mixed in a mixing machine for production of the coating type granules so that the oil-nonabsorbing granular carrier is coated with the adhesive, the agrochemical active ingredient, and if necessary the mineral fine powder etc. To coat the granular carrier (via the adhesive) with a nearly total amount of the agrochemical active ingredient added, these components should be mixed often for a long time, resulting in the problem of significantly lowered productivity of granules.

[0010]

[Means to solve the Problem]

As a result of their eager study for solving the problems described above, the present inventors found that the problems can be solved by using a water-insoluble thermoplastic resin in the form of an emulsion in water as an adhesive in coating of an oil-nonabsorbing granular carrier with an agrochemical active ingredient or with a mixture of an agrochemical active ingredient and an inert fine powder, and the present invention was thereby completed.

[0011]

That is, the present invention relates to coating type granules for agriculture and horticulture and process for production of the same wherein a water-insoluble thermoplastic resin in the form of an emulsion in water is used as an adhesive to coat an oil-nonabsorbing granular carrier with 1 or more agrochemical active ingredients or with a mixture of 1 or more agrochemical active ingredients and an inert fine powder.

[0012]

The process for producing the granules for agriculture and horticulture according to the present invention is as follows: The process comprises adding a water-insoluble thermoplastic resin in the form of an emulsion in water to an oil-nonabsorbing granular carrier under stirring thereby coating said carrier uniformly with said resin, and then

stirring the carrier as such while adding an agrochemical active ingredient or a mixture of an agrochemical active ingredient and an inert fine powder whereby the oil-nonabsorbing granular carrier is coated with the agrochemical active ingredient or with the mixture of an agrochemical active ingredient and an inert fine powder.

[0013]

In the process for producing agrochemical granules according to the present invention, the granules can be produced whether the agrochemical ingredient is solid or liquid at normal temperature, and 2 or more agrochemical active ingredients can also be contained in the granules. If the agrochemical granules containing 2 or more agrochemical active ingredients are to be produced, the 2 or more agrochemical active ingredients may previously mixed, or alternatively the oil-nonabsorbing carrier is coated with a first agrochemical active ingredient and then coated with a second and subsequent agrochemical active ingredients.

[0014]

According to the present invention, the agrochemical active ingredients, when the granules are rubbed against one another at the time of transportation and spraying, are hardly removed from the granular carrier, so there can be provided granules which can be used safely because there is no or less agrochemical active ingredients which after removed at the time

of application by spraying are inhaled by the worker or scattered in the environment. Further, in production of the coating type granules, the time for coating of the granular carrier (via an adhesive) with a nearly total amount of the agrochemical active ingredient added can be significantly reduced. Further, because the organic solvent is not used, there is none of the problem of flammability at the time of production and transportation, neither is there the problem of the stimulation and toxicity of the evaporated organic solvent toward the worker at the time of production and transportation.

[0015]

In the present invention, the agrochemical active ingredient means any active compounds which can be usually used to protect plants. Preferably, these include insecticides, roundworm-killing agents, tick-killing agents, bactericides, herbicides and plant growth regulators, and these can be contained solely or as a mixture thereof. Specifically, these include, but are not limited to, the following compounds.

[0016]

The herbicides include:

(1) ethyl 5-(4,6-dimethoxypyrimidine-2-ylcarbamoyl sulfamoyl)-1-methylpyrazole-4-carboxylate (general name: Pyrazosulfuron ethyl), (2) methyl 5-[[[[(4,6-dimethoxy-2-pyrimidinyl) amino] carbonyl] amino] sulfonyl]-3-chloro-1-

methyl-1-H-pyrazole-4-carboxylate, (3) methyl α-(4,6-dimethoxypyrimidine-2-ylcarbamoyl sulfamoyl)-O-toluate (general name: Benzulfuron methyl), (4) 1-(4,6-dimethoxy-1,3,5-triazine-2-yl)-3-[2-(2-ethoxyethoxy) phenylsulfonyl] urea (general name: Shinosulfuron), (5) N-(2-chloroimidazo [1,2-a] pyridine-3-ylsulfonyl)-N'-(4,6-dimethoxy-2-pyrimidinyl) urea (general name: Imazosulfuron).

[0017]

(6) ethyl=(RS)-2-[4-(6-chloroquinoxaline-2-yloxy) phenoxy] propionate (general name: Quizarohop ethyl), (7) 2-chloro-2',6'-diethyl-N-(2-propoxyethyl) acetanilide (general name: Pretirachlor), (8) ammonium=DL-homoalanine-4-yl (methyl) phophinate (general name: Gluphocinate), (9) 5-tert-butyl-3-(2,4-dichloro-5-isopropoxyphenyl)-1,3,4-oxaziazoline-2-one (general name: Oxaziazone), (10) methyl-N-(3,4-dichlorophenyl) carbamate (general name: MCC).

[0018]

(11) 3-isopropyl-2,1,3-benzo-thiadiazinone-(4)-2,2-dioxide (general name: Bentazone), (12) 2,4-dichlorophenoxy acetic acid (general name: 2,4-D), (13) 2-methyl-4-chlorophenoxy acetic acid (general name: MCP), (14) 2-methylthio-4,6-bis(isopropylamino)-s-triazine (general name: Promethorin), (15) 2-methylthio-4-ethylamino-6-isopropylamino-s-triazine (general name: Ametrin).

[0019]

(16) 2-chloro-4,6-bis(ethylamino)-s-triazine (general name: Cimazine), (17) 2-chloro-4-ethylamino-6-isopropylamino-s-triazine (general name: Atrazine), (18) 2-benzothiazole-2-yloxy-N-methyl acetanilide (general name: Mephenacet), (19) 2-methylthio-4-ethylamino-6-(1,2-dimethylpropylamino)-s-triazine (general name: Dimethamethorin), (20) 5-dipropylamino-α,α,α-trifluoro-4,6-dinitro-o-toluidine (general name: Prodiamine).

[0020]

(21) α,α,α-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine (general name: Trifluraline), (22) 2,4-dichlorophenyl-3'-methoxy-4'-nitrophenyl ether (general name: Chromethoxynyl) and (23) methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate (general name: Biphenox).

[0021]

The insecticides include: (1) 2-tert-butyl-5-(4-tert-butylbenzylthio)-4-chloropyridazine-3(2H)-one (general name: Pyridaben), (2) 1-naphthyl-N-methyl carbamate (general name: NAC), (3) 3,7,9,13-tetramethyl-5,11-dioxa-2,8,14-trithia-4,7,9,12-tetraazapentadeca-3,12-diene-6,10-dione (general name: Thiodicarp), (4) 3-methyl-1,5-bis(2,4-xylyl)-1,3,5-triazapenta-1,4-diene (general name: Amitraz), (5) 3,6-bis(2-chlorophenyl)-1,2,4,5-tetrazine (general name: Chlophentezine).

[0022]

(6) hexakis(β,β-dimethylphenethyl) distannoxane (general name: Phenebutatin oxide), (7) isopropyl 4,4'-dibromobenzylate (general name: Phenysobromolate), (8) 1-(6-chloro-3-pyridyl methyl)-N-nitro (imidazolizine-2-ylidene) amine (general name: Imidachlobride), (9) 2-(4-ethoxyphenyl)-2-methyl propoyl-3-phenoxybenzyl ether (general name: Etophenebrox), (10) 2-methylbiphenyl-3-yl methyl=(Z)-(1RS,3RS)-3-(2-chloro-3,3,3-trifluoropropa-1-enyl)-2-2-dimethyl cyclopropane carboxylate (general name: Biphentrin).

[0023]

(11) 1,3-bis(carbamoylthio)-2-(N,N-dimethylamino) propane hydrochloride (general name: Caltup), (12) 2-isopropoxyphenyl-N-methyl carbamate (general name: PHC), (13) O,S-dimethyl-N-acetyl phosphoroamide thioate (general name: Acephate), (14) 2,3-dihydro-2,2-dimethyl-7-benzo[b]franyl=N-dibutyl aminothio-N-methyl carbamate (general name: Carbosulphane), (15) 5-amino-1-(2,6-dichloro-4-trifluoromethyl phenyl)-3-cyano-4-trifluoromethanesulfinyl pyrazole (general name: Fibronyl).

[0024]

(16) ethyl=N-[2,3-dihydro-2,2-dimethyl benzofuran-7-yloxycarbonyl(methyl)aminothio]-N-isopropyl-β-alaninate (general name: Benflacalp), (17) O,O-dipropyl-O-4-methyl thiophenyl phosphate (general name: Propaphos), and (18)

(2-isopropyl-4-methyl pyrimidyl-6)-diethyl thiophosphate (general name: Diadinone).

[0025]

The bactericides include: (1) 2,4'-dichloro-α-(pyrimidine-5-yl) benzhydryl=alcohol (general name: Phenarimol), (2) 8-hydroxyquinoline copper (general name: Oxycine copper), (3) 5-methyl-1,2,4-triazolo [3,4-b] benzothiazol (general name: Tricyclazol), (4) 3-(3,5-dichlorophenyl)-N-isopropyl-2,4-dioxoimidazolidine-1-carboxamide (general name: Ipurodione), (5) N-trichloromethyl thiotetrahydrophthalimide (general name: Captane).

[0026]

(6) 2,6-dichloro-4-nitroaniline (general name: CNA), (7) α,α,α-trifluoro-3'-isopropoxy-O-toluanilide (general name: Fultranil), (8) 3-allyloxy-1,2-benzoisothiazole-1,1-dioxide (general name: Propenazole), (9) diisopropyl=1,3-dithiolane-2-ilydene-malonate (general name: Isobuthiolane), (10) 1,2,5,6-tetrahydropyrrolo[3,2,1-ij]quinoline-4-one (general name: Pyrroquilone).

[0027]

(11) 6-(3,5-dichloro-4-methyl phenyl)-3(2H)-pyrridazinone (general name: Dichlomezine), (12) 1-(4-chlorobenzyl)-1-cyclopentyl-3-phenyl urea (general name: Pencyclon), (13) methyl-(E)-methoxyimino [α-(O-tolyloxy)) O-tolyl]-acetate, (14) (E)-2-methoxyimino-N-methyl-2-(2-phenoxyphenyl)

acetamide, and (15) methyl 2-{2-(4-[2-cyanophenoxy] pyrimidine-6-yloxy) phenyl}-2-methoxypropionate.

[0028]

In the present invention, the inert fine powder to be mixed with the agrochemical active ingredient is a fine powder which does not exhibit any activity toward living creatures in the range where the granules of the present invention are used, and it is not particularly limited and may be an inorganic material or organic material. If the content of the agrochemical active ingredient in granules is low and the granular carrier is not coated uniformly therewith, the inert fine powder can be mixed with the agrochemical active ingredient to improve the uniformity of the coating.

[0029]

If the agrochemical active ingredient is liquid, the absorbing fine powder and the liquid agrochemical active ingredient are mixed, then powdered, and applied onto a granular carrier whereby the agglomeration of granules due to adhesion can be prevented. The absorbing fine powder includes e.g. colloidal silicon oxide, synthetic calcium silicate, synthetic magnesium silicate, porous calcium carbonate, diatomaceous earth, and talc.

[0030]

The diameter of the inert fine powder is preferably about 0.1 to 100 μm, but is not particularly limited. In the present

invention, the oil-nonabsorbing granular carrier is specifically e.g. limestone, calcium carbonate, silica sand, silica rock and glass beads. The diameter of the oil-nonabsorbing granular carrier is preferably about 0.1 to 1.0 mm, but is not particularly limited.

[0031]

The water-insoluble thermoplastic resin used as the adhesive in the present invention can be used without any particular limitation insofar as it is in the form of an emulsion in water, and even a powdery resin can be used as the adhesive insofar as it can be easily emulsified in water. Further, one resin or a combination of resins may be used. Hereinafter, particularly preferable water-insoluble thermoplastic resins as the adhesive in the present invention are mentioned along with their specific trade names.

[0032]

(1) Polyvinyl acetate

Movinyl DC: Hoechst Gosei Co., Ltd.

Movinyl powder SA: Hoechst Gosei Co., Ltd.

Polyzole PS-10: Showa Highpolymer Co., Ltd.

(2) Vinyl acetate-ethylene copolymer

Movinyl 180E: Hoechst Gosei Co., Ltd.

Movinyl 181E: Hoechst Gosei Co., Ltd.

Polyzole EVA P-4: Showa Highpolymer Co., Ltd.

(3) Vinyl acetate-vinyl versatate copolymer

Movinyl powder DM200: Hoechst Gosei Co., Ltd.

(4) Vinyl acetate-ethylene-vinyl chloride copolymer

Movinyl 123E: Hoechst Gosei Co., Ltd.

(5) Polyacrylate

Movinyl 747: Hoechst Gosei Co., Ltd.

AE336: Nippon Latex Co., Ltd.

Polyzole AT-130: Showa Highpolymer Co., Ltd.

[0033]

(6) Acrylate-styrene copolymer

Movinyl 880: Hoechst Gosei Co., Ltd.

Polyzole PSA SE-1400: Showa Highpolymer Co., Ltd.

(7) Acrylate-silicone copolymer

SX800 (B): Japan Synthetic Rubber Co., Ltd.

Kanebinol KD56: Kanebo NSC Co., Ltd.

(8) Acrylate-ethylene copolymer

N-700s: Toho Chemical Industry Co., Ltd.

(9) Polyurethane

Superflex 300: Dai-ichi Kogyo Seiyaku Co., Ltd.

(10) Styrene-butadiene copolymer

0561: Japan Synthetic Rubber Co., Ltd.

Nipol LX437: Nippon Zeon Co., Ltd.

[0034]

(11) Acrylonitrile-butadiene copolymer

Nipol LX515: Nippon Zeon Co., Ltd.

Nipol 1577: Nippon Zeon Co., Ltd.

The content of water-insoluble thermoplastic resin used as the adhesive is preferably 0.1 to 5 % by weight, more preferably 0.2 to 2 % relative to the granules of the present invention. If the content of the water-insoluble thermoplastic resin is 0.1 % by weight or less, the agrochemical active ingredient is easily removed from the granular carrier due to rubbing of granules against one another, thus failing to exhibit the effects of the present invention, whereas a content of 5 % by weight or more is uneconomical because the resin does not exhibits its effect in proportion to its amount. Further, water-soluble adhesives may be used in combination as necessary, and specific examples include:

[0035]

(1) starch type natural products such as soluble starch, carboxymethyl starch and dextrin;

(2) natural substances such as sodium alginate, gum arabic, gelatin and casein;

(3) cellulose derivatives such as methyl cellulose;

(4) polyvinyl alcohol;

(5) polyvinyl methyl ether;

(6) polyvinyl pyrrolidone;

[0036]

(7) vinyl pyrrolidone-vinyl acetate copolymer;

(8) polyacrylamide;

(9) polymers or copolymers of acrylic acid, methacrylic acid

or salts thereof;

(10) polyethylene glycol; and

(11) polyethylene oxide.

[0037]

In the granules for agriculture and horticulture according to the present invention, stabilizers, dispersants and coloring agents for agrochemical active ingredients can be used as necessary. The stabilizers include e.g. epoxidized soybean oil, epoxidized linseed oil, epoxidized cottonseed oil, epoxidized fatty acid esters, ethylene glycol glycidyl ethers, alkyl phosphate derivatives and diethylene glycol, the dispersants include e.g. lignin sulfonic acid, naphthalene sulfonate-formalin condensate, polycarboxylates, alkyl benzene phosphate, alkyl benzene sulfonate, tripolyphosphate and metaphosphate, and the coloring agents include e.g. edible yellow No. 4 (Tatoradine), edible red No. 3 (Elthrosin), edible blue No. 1 (Brilliant Blue FCF), and edible blue No. 2 (Indigocalmine), and a mixture of 2 or more of these coloring agents may also be used.

[0038]

[EXAMPLES]

Hereinafter, the formulation, production process and test method of the granules for agriculture and horticulture according to the present invention are described in detail by reference to the Examples, which however are not intended to

limit the present invention. Hereinafter, "parts" means parts by weight.

[0039]

Example 1

3.3 parts of Benflacalb (general name), 0.2 part of New Sizer 5 10R (epoxidized soybean oil, from Nippon Oil and Fats Co., Ltd.), 0.2 part of diethylene glycol, 0.2 part of Vanirex N (sodium lignin sulfonate, from Sanyo-Kokusaku Pulp Co., Ltd.), and 4.0 parts of absorbing fine powder Microcell E (synthetic calcium silicate, from Johns Manville Co., Ltd.) were stirred and mixed in a planetary mixer (universal mixer, from Dalton Co., Ltd.) and then disrupted and mixed in an impact type grinding machine (Sample Mill, from Fuji Powder Co., Ltd.), whereby these were uniformly dispersed. This mixture is referred to as mixture A.

[0040]

Then, while 91.6 parts of silica sand (oil-nonabsorbing granular carrier) was stirred in a planetary mixer (universal mixer, from Dalton Co., Ltd.), an adhesive solution containing 1.0 part of Movinyl DC (polyvinyl acetate, from Hoechst Gosei Co., Ltd.) diluted with a suitable amount of water was added thereto so that the silica sand was coated uniformly with the adhesive solution. Then, 7.9 parts of the above mixture A were added to the silica sand coated uniformly with the adhesive solution, and they were stirred and mixed for 15 minutes whereby

the silica sand was uniformly coated with mixture A and then dried in a fluidized bed dryer (Mizette dryer, from Fuji Powder Co., Ltd.) to give the granules for agriculture and horticulture according to the present invention.

[0041]

Example 2

2.2 parts of Calbosulfan (general name), 1.1 part of Fibronyl (general name), 0.2 part of New Sizer 510R (Nippon Oil and Fats Co., Ltd.), 0.1 part of diethylene glycol, 0.1 part of Vanirex N (Sanyo-Kokusaku Pulp Co., Ltd.) and 2.6 parts of Microcell E (Johns Manville Co., Ltd.) were stirred and mixed in a planetary mixer (universal mixer, from Dalton Co., Ltd.) and then disrupted and mixed in an impact type grinding machine (Sample Mill, from Fuji Powder Co., Ltd.), whereby these were uniformly dispersed. This mixture is referred to as mixture B.

[0042]

Then, while 93.2 parts of silica sand (oil-nonabsorbing granular carrier) was stirred in a planetary mixer (universal mixer, from Dalton Co., Ltd.), an adhesive solution containing 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.) diluted with a suitable amount of water was added thereto so that the silica sand was coated uniformly with the adhesive solution. Then, 6.3 parts of the above mixture B were added to the silica sand coated uniformly with the adhesive solution, and they were

stirred and mixed for 15 minutes whereby the silica sand was uniformly coated with mixture A and then dried in a fluidized bed dryer (Mizette dryer, from Fuji Powder Co., Ltd.) to give the granules for agriculture and horticulture according to the present invention.

[0043]

Example 3

1.1 parts of Fibronyl (general name), 3.5 parts of Propenazole (general name) and 0.1 part of Vanirex N (Sanyo-Kokusaku Pulp Co., Ltd.) were stirred and mixed in a planetary mixer (universal mixer, from Dalton Co., Ltd.) and then disrupted and mixed in an impact type grinding machine (Sample Mill, from Fuji Powder Co., Ltd.), whereby these were uniformly dispersed. This mixture is referred to as mixture C.

[0044]

Then, while 94.8 parts of silica sand (oil-nonabsorbing granular carrier) was stirred in a planetary mixer (universal mixer, from Dalton Co., Ltd.), an adhesive solution containing 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.) dispersed in a suitable amount of water was added thereto so that the silica sand was coated uniformly with the adhesive solution. Then, 4.7 parts of the above mixture C were added to the silica sand coated uniformly with the adhesive solution, and they were stirred and mixed for 15 minutes whereby the silica sand was

uniformly coated with mixture C and then dried in a fluidized bed dryer (Mizette dryer, from Fuji Powder Co., Ltd.) to give the granules for agriculture and horticulture according to the present invention.

[0045]

Example 4

1.1 parts of Fibronyl (general name), 0.1 part of Vanirex N (Sanyo-Kokusaku Pulp Co., Ltd.) and 0.1 part of Microcell E (Johns Manville Co., Ltd.) were stirred and mixed in a planetary mixer (universal mixer, from Dalton Co., Ltd.) and then disrupted and mixed in an impact type grinding machine (Sample Mill, from Fuji Powder Co., Ltd.), whereby these were uniformly dispersed. This mixture is referred to as mixture D.

[0046]

Then, while 98.2 parts of silica sand (oil-nonabsorbing granular carrier) was stirred in a planetary mixer (universal mixer, from Dalton Co., Ltd.), an adhesive solution containing 1.0 part of Movinyl 181E (vinyl acetate-ethylene polymer, from Hoechst Gosei Co., Ltd.) diluted with a suitable amount of water was added thereto so that the silica sand was coated uniformly with the adhesive solution. Then, 1.3 parts of the above mixture D were added to the silica sand coated uniformly with the adhesive solution, and they were stirred and mixed for 15 minutes whereby the silica sand was uniformly coated with

mixture D, and then dried in a fluidized bed dryer (Mizette dryer, from Fuji Powder Co., Ltd.) to give the granules for agriculture and horticulture according to the present invention.

[0047]

Example 5

Granules in Example 5 were obtained in the same manner as in Example 4 except that an adhesive solution having 0.5 part of Movinyl DM200 (vinyl acetate-vinyl versatate copolymer, from Hoechst Gosei Co., Ltd.) dispersed in a suitable amount of water was added in place of the adhesive solution of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.) diluted with a suitable amount of water.

[0048]

Example 6

Granules in Example 6 were obtained in the same manner as in Example 4 except that 1.0 part of Movinyl 123E (vinyl acetate-ethylene-vinyl chloride copolymer, from Hoechst Gosei Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0049]

Example 7

Granules in Example 7 were obtained in the same manner as in Example 4 except that 1.0 part of AE336 (polyacrylate, from Nippon Latex Co., Ltd.) was used in place of 1.0 part of

Movinyl DC (Hoechst Gosei Co., Ltd.).

[0050]

Example 8

Granules in Example 8 were obtained in the same manner as in Example 4 except that 1.0 part of Movinyl 880 (acrylate-styrene copolymer, from Hoechst Gosei Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0051]

Example 9

Granules in Example 9 were obtained in the same manner as in Example 4 except that 1.0 part of SX800(B)-04 (acrylate-silicone copolymer, from Japan Synthetic Rubber Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0052]

Example 10

Granules in Example 10 were obtained in the same manner as in Example 4 except that 1.0 part of N-700S (acrylate-ethylene copolymer, from Toho Chemical Industry Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0053]

Example 11

Granules in Example 11 were obtained in the same manner

as in Example 4 except that 1.0 part of Superflex 300 (polyurethane, from Dai-ichi Kogyo Seiyaku Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0054]

Example 12

Granules in Example 12 were obtained in the same manner as in Example 4 except that 1.0 part of 0561 (styrene-butadiene copolymer, from Japan Synthetic Rubber Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0055]

Example 13

Granules in Example 13 were obtained in the same manner as in Example 4 except that 1.0 part of Nipol LX515 (acrylonitrile-butadiene copolymer, from Nippon Zeon Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0056]

Comparative Example 1

Granules in Comparative Example 1 were obtained in the same manner as in Example 1 except that 0.5 part of PVP K-30 (polyvinyl pyrrolidone, from ISP Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0057]

Comparative Example 2

Granules in Comparative Example 2 were obtained in the

same manner as in Example 1 except that in Example 2, 0.5 part of PVP K-30 (polyvinyl pyrrolidone, from ISP Co., Ltd.) was used in place of 1.0 part of Movinyl DC (Hoechst Gosei Co., Ltd.).

[0058]

Example 14

1.1 parts of Fibronyl (general name), 0.1 part of Vanirex N (Sanyo-Kokusaku Pulp Co., Ltd.) and 0.1 part of absorbing fine powder Microcell E (Johns Manville Co., Ltd.) were stirred and mixed in a planetary mixer (universal mixer, from Dalton Co., Ltd.) and then disrupted and mixed in an impact type grinding machine (Sample Mill, from Fuji Powder Co., Ltd.), whereby these were uniformly dispersed. This mixture is referred to as mixture D.

[0059]

Then, while 98.2 parts of silica sand (oil-nonabsorbing granular carrier) was stirred in a planetary mixer (universal mixer, from Dalton Co., Ltd.), an adhesive solution containing 0.5 part of Movinyl DC (Hoechst Gosei Co., Ltd.) dispersed in a suitable amount of water was added thereto so that the silica sand was coated uniformly with the adhesive solution. Then, 1.3 parts of the above mixture D were added to the silica sand coated uniformly with the adhesive solution, and they were stirred and mixed for 15 minutes whereby the silica sand was uniformly coated with mixture D, and then dried in a fluidized

bed dryer (Mizette dryer, from Fuji Powder Co., Ltd.) to give the granules for agriculture and horticulture according to the present invention.

[0060]

Example 15

Granules in Example 15 were obtained in the same manner as in Example 14 except that mixture D added to the silica sand coated uniformly with the adhesive solution was stirred and mixed for 30 minutes instead of 15 minutes.

[0061]

Example 16

Granules in Example 16 were obtained in the same manner as in Example 14 except that mixture D added to the silica sand coated uniformly with the adhesive solution was stirred and mixed for 45 minutes instead of 15 minutes.

[0062]

Comparative Example 3

Granules in Comparative Example 3 were obtained in the same manner as in Example 14 except that 0.5 part of PVP K-30 (polyvinyl pyrrolidone, from ISP Co., Ltd.) was used in place of 1.0 part of Movinyl DC (polyvinyl acetate, from Hoechst Gosei Co., Ltd.).

[0063]

Comparative Example 4

Granules in Comparative Example 4 were obtained in the

same manner as in Example 3 except that mixture D added to the silica sand coated uniformly with the adhesive solution was stirred and mixed for 30 minutes instead of 15 minutes.

[0064]

Comparative Example 5

Granules in Comparative Example 5 were obtained in the same manner as in Example 3 except that mixture D added to the silica sand coated uniformly with the adhesive solution was stirred and mixed for 45 minutes instead of 15 minutes.

[0065]

Test Example 1. Abrasion-resistance test of the granules

100 g sample was placed on a screen (inner diameter, 200 mm; depth, 45 mm) with a 106 μm opening, arranged on a saucer, and then it was capped, attached to a low-tap screening tester, and subjected to screening for 20 minutes (number of revolutions, 241 rpm; number of tappings, 129 tpm). The weight of the sample accumulated on the saucer was weighed (balances capable of weighing 0.01 g at the minimum was used), and the degree of particle size reduction (%) was calculated according to the following equation. A lower degree of particle size reduction indicates better abrasion resistance.

[0066]

Degree of particle size reduction (%) = [Sample (g) accumulated on the saucer/sample (100 g)] × 100

The results are shown in Table 1.

[0067]

Table 1

	Degree of particle size reduction (%)
Granules in Example 1	<0.01%
Granules in Example 2	<0.01%
Granules in Example 3	<0.01%
Granules in Example 4	<0.01%
Granules in Example 5	<0.01%
Granules in Example 6	<0.01%
Granules in Example 7	<0.01%
Granules in Example 8	<0.01%
Granules in Example 9	<0.01%
Granules in Example 10	<0.01%
Granules in Example 11	<0.01%
Granules in Example 12	<0.01%
Granules in Example 13	<0.01%
Granules in Com. Ex. 1	0.22%
Granules in Com. Ex. 2	0.17%

[0068]

Test Example 2. Measurement of the content of the granular agrochemical active ingredient in the granules

The amount of the agrochemical active ingredient in the sample granules was measured by high performance liquid chromatography, and the content of the ingredient (%) was calculated according to the following equation:

Content of the ingredient (%) = [weight of the agrochemical active ingredient in the sample granules/weight of the sample granules] × 100

The results are shown in Table 2.

[0069]

Table 2

	Mixing time(min)	Content of ingredient (%)
Granules in Example 14	15	1.1
Granules in Example 15	30	1.1
Granules in Example 16	45	1.1
Granules in Com. Ex. 3	15	0.8
Granules in Com. Ex. 4	30	1.0
Granules in Com. Ex. 5	45	1.1

[0070]

In Table 2, the content of the ingredient becomes 1.1 % if the granular carriers have been coated (via the adhesive) with the total amount of the agrochemical active ingredient added. As can be seen from Table 2, the coating of the granular particles with the agrochemical active ingredient in the granules of the present invention (Examples 3, 4 and 5) is completed by mixing in a shorter time than in the comparative granules (Comparative Examples 3, 4 and 5), indicating superior productivity of granules.

[0071]

[Effects of the Invention]

According to the granules for agriculture and horticulture according to the present invention, the agrochemical active ingredients, when the granules are rubbed against one another at the time of transportation and spraying, are hardly removed from the granular carrier, so the granules can be used safely because there is no or less agrochemical

active ingredients which after removed at the time of application by spraying, are inhaled by the worker or scattered in the environment. Further, in production of the granules for agriculture and horticulture according to the present invention, the time required for the granular carrier to be coated (via an adhesive) with a nearly total amount of the agrochemical active ingredient added can be significantly reduced, thus improving productivity of the granules.